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(54) **FAN MOTOR APPARATUS FOR VACUUM CLEANER**

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H02K 5/24 (2006.01)

(52) **U.S. Cl.** **310/51**; 415/119; 15/326

(58) **Field of Classification Search** 310/51; 415/119; 15/326; *H02K 5/24*
See application file for complete search history.

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(57) **ABSTRACT**

A fan motor apparatus for a vacuum cleaner is provided. The fan motor apparatus may include a fan motor, an outer casing surrounding at least a part of the fan motor, wherein the outer casing includes a discharge portion having a discharge port; and, a noise-absorbent member is supported by the discharge port such that the port is closed, wherein the noise-absorbent member changes its shape to form a leakage space when internal exhaust pressure of the fan motor exceeds a predetermined degree.

5 Claims, 5 Drawing Sheets

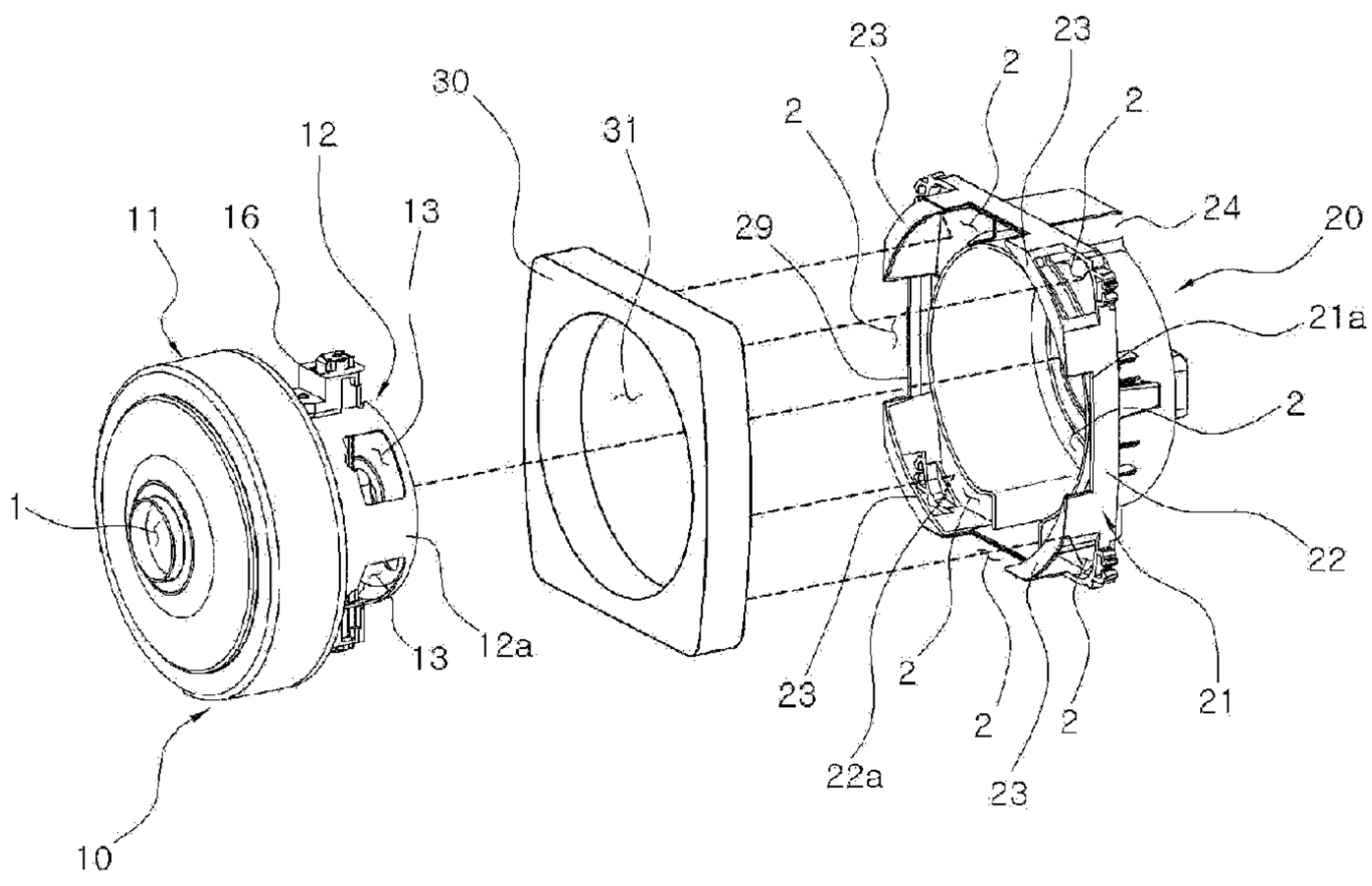

FIG. 1

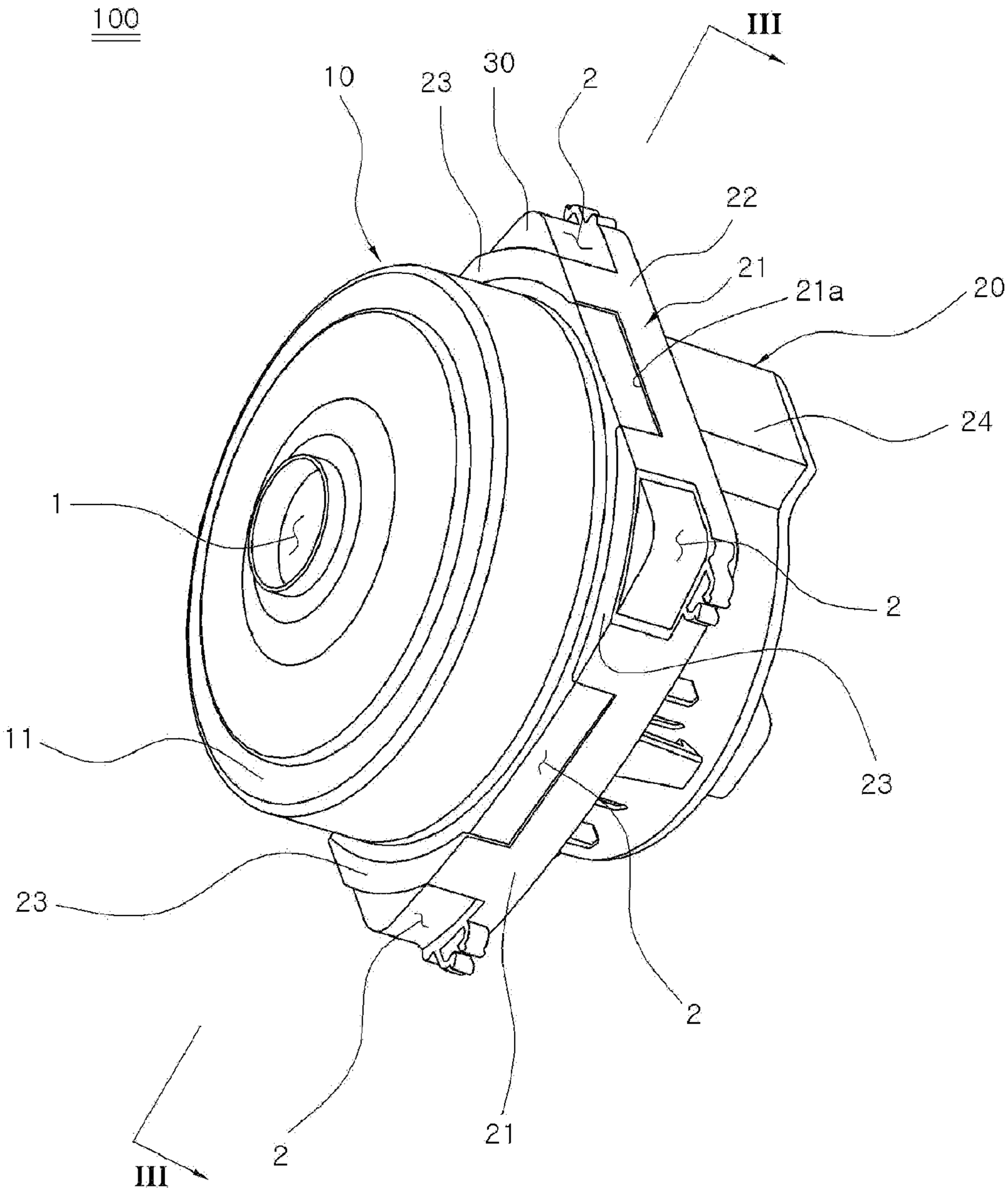

FIG. 2

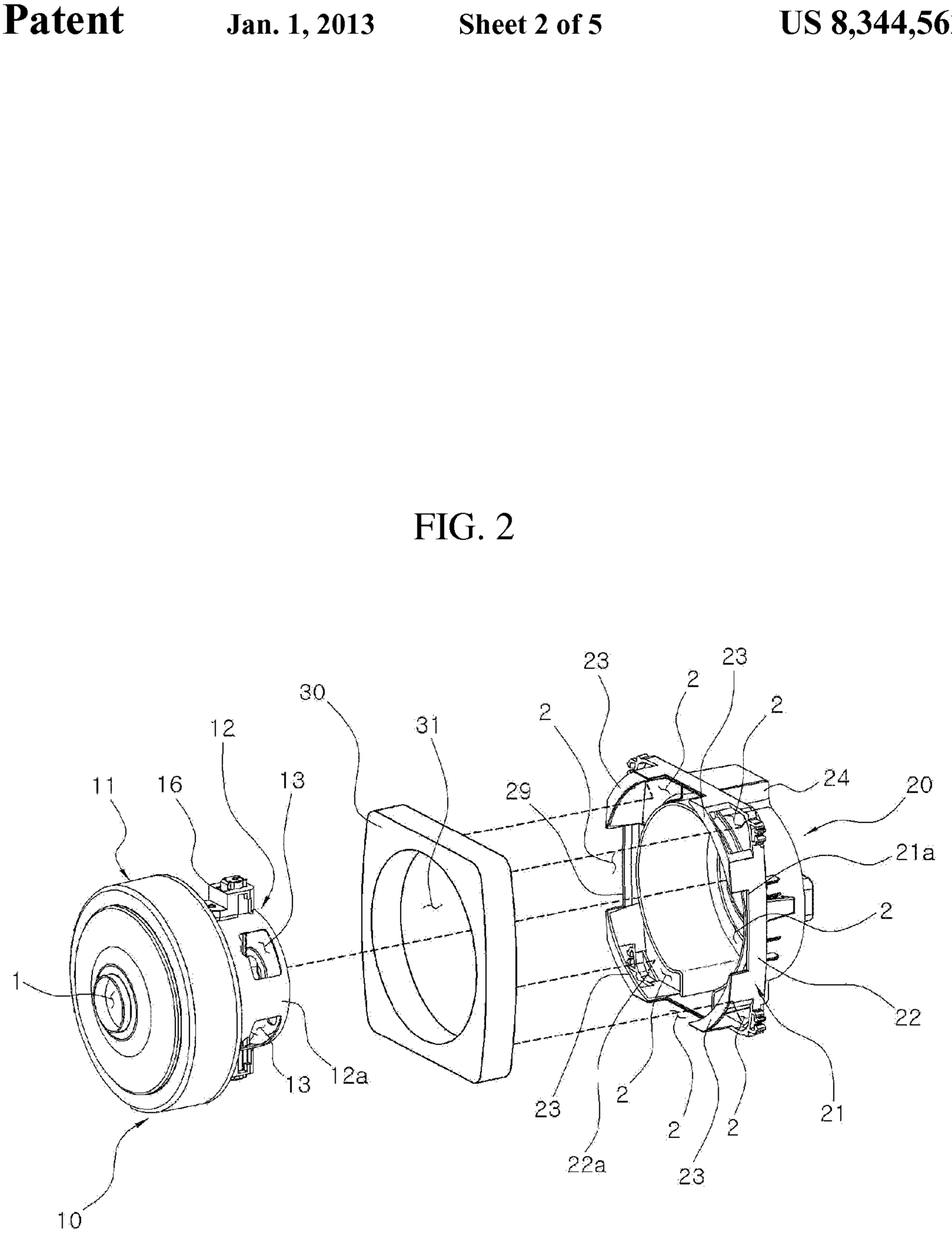
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FIG. 3

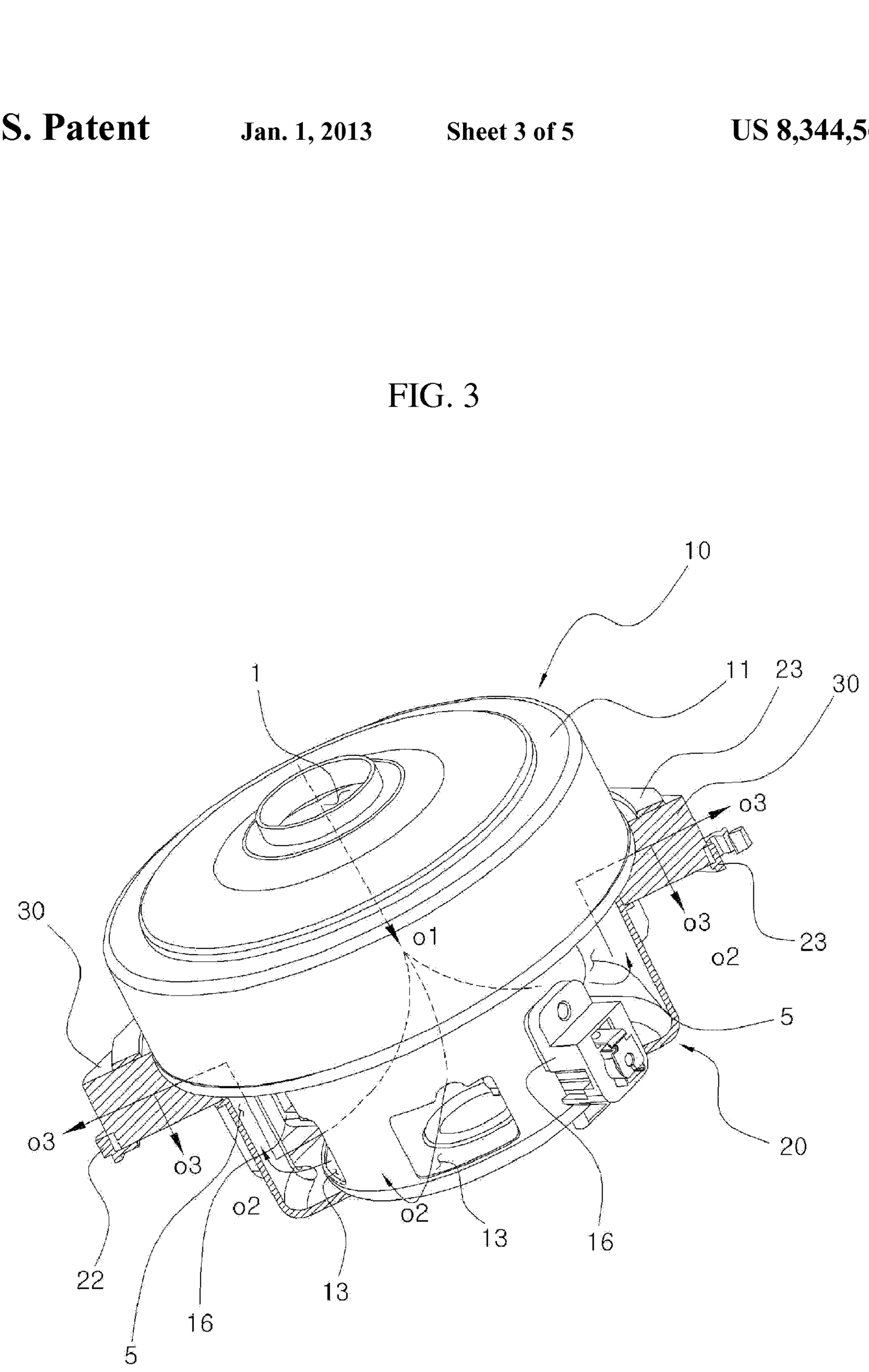


FIG. 4

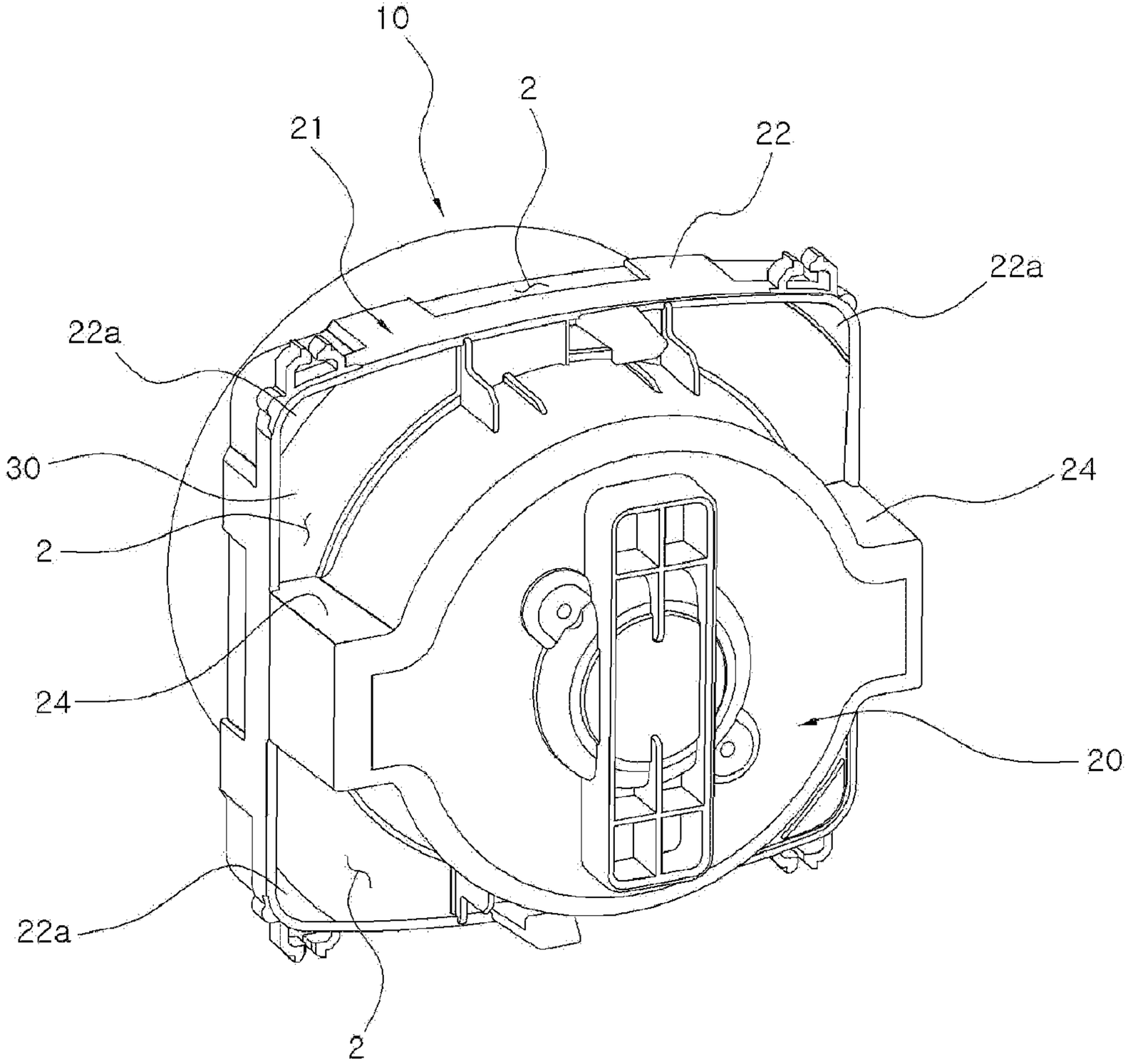
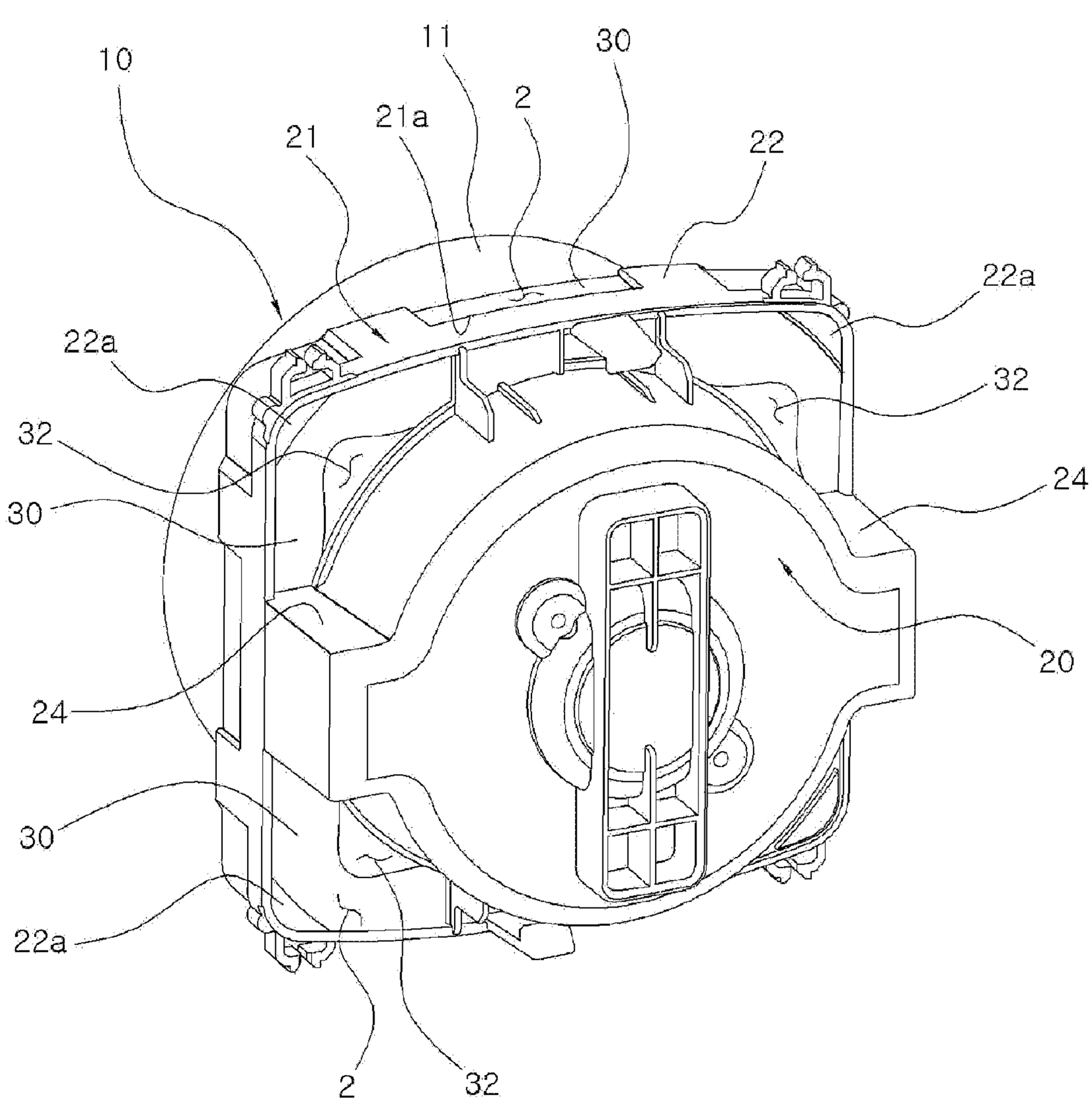


FIG. 5



FAN MOTOR APPARATUS FOR VACUUM CLEANER

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application claims the benefit under 35 U.S.C. §119 (a) of a Korean Patent Application No. 10-2009-0034457, filed on Apr. 21, 2009, in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference for all purposes.

BACKGROUND

1. Field

The following description relates to a vacuum cleaner, and more particularly, to a fan motor apparatus for a vacuum cleaner, which is adapted for use in a domestic, industrial, or commercial vacuum cleaner.

2. Description of the Related Art

A vacuum cleaner may generally employ a fan motor apparatus to forcibly draw in an external air stream from which foreign matter, such as dusts, may be removed.

The fan motor apparatus may include a plurality of vanes formed on a motor shaft, which may rotate to generate suction force as the motor starts driving. The generated suction force draws in the external air stream and dusts from the surface being cleaned into a centrifugal separator. Additionally, the generated suction force of the fan motor apparatus causes the drawn air in the centrifugal separator to rotate and shed foreign matters. A cleaned airstream, from which dust has been removed, is then discharged out. At this time, the fan motor apparatus and the drawn air stream generate noise. This is the main cause of the noise generally occurring in a vacuum cleaner.

Accordingly, various kinds of fan motor apparatuses and sealing members have been suggested in an attempt to reduce noise of the fan motor apparatus.

By way of example, Korean Registered Patent No. 10-0133743 entitled 'Cleaner having a rear noise insulating cover', Korean Registered Patent No. 10-0133744 entitled 'Noise-absorbing chamber of a vacuum cleaner having a spiral tube', Korean Registered Patent No. 10-0233513 entitled 'Motor mounting structure of vacuum cleaner', U.S. Pat. No. 5,159,738 entitled 'Vacuum cleaner having silence mechanism', and European Patent No. EP 453296 entitled 'Vacuum cleaner' pertain to such examples of a fan motor apparatus.

The above-mentioned examples suggest a dual casing to extend a discharge passage of a fan motor to reduce noise of a fan motor apparatus, and a noise-absorbent member arranged inside the dual casing, without being exposed, and fixed by adhesives or the like to prevent dislocation or deformation thereof.

Although the noise-absorbent members of the above examples may be able to reduce noise by absorbing the discharging air noise, problems may arise as minute foreign matters left unfiltered in the air stream may become caught within the noise-absorbent member and accumulated as the air stream is continuously discharged. That is, the foreign matters, once trapped in the noise-absorbent member, may deteriorate the air discharging and silencing efficiency. Therefore, it is necessary to clean or replace the noise-absorbent member periodically.

However, according to the above examples, the noise-absorbent members are arranged inside the dual casing without being exposed, making replacement or cleaning job difficult.

Due to uneasy access to the noise-absorbent member, the noise-absorbent members are often left with foreign matters caught therein, so the air discharging efficiency gradually deteriorates. However, the noise-absorbent member, when left unattended with the deteriorating discharging efficiency, mainly causes internal exhaust pressure of the fan motor apparatus to rise. The increase of internal exhaust pressure of the fan motor apparatus may cause a motor to operate under overload, make bigger noise, and possibly become overheated, thereby damaging the motor.

Further, the examples above generally employ dual casing structure to extend passage of discharged air stream, thereby complicating the structure of a fan motor apparatus, and also requiring an increased number of parts. Due to the complicated structure and need for an increased number of parts of a fan motor apparatus, fabrication of a vacuum cleaner may be difficult, manufacture cost may increase, and productivity may deteriorate.

Further yet, due to increased number of parts and complicated structure, a fan motor apparatus may have a limited compactness, and as a result, an apparatus, such as a vacuum cleaner employing the fan motor apparatus, may also be difficult to make compact.

Further, the limited compactness of a vacuum cleaner may also cause inconvenience to a user, who has to operate a large-sized vacuum cleaner.

SUMMARY

The following description relates to a fan motor apparatus for a vacuum cleaner. The fan motor apparatus includes a fan motor, an outer casing surrounding at least a part of the fan motor, wherein the outer casing includes a discharge portion having a discharge port, and a noise-absorbent member supported by the discharge port such that the discharge port is closed, wherein the noise-absorbent member changes its shape to form a leakage space when an internal exhaust pressure of the fan motor exceeds a predetermined degree.

The discharge portion may include a side frame to form the discharge port and configured to support the noise-absorbent member.

The side frame may include at least one recessed portion extending downwardly from an upper portion.

The side frame may further include a support portion protruding from a lower inner portion of the side frame configured to support a lower surface of the noise-absorbent member.

The discharge portion may further include at least one upper frame configured to support an upper surface of the noise-absorbent member on an upper portion of the side frame.

The noise-absorbent member may be returned to an original shape if the internal exhaust pressure of the fan motor is returned to a degree less than the predetermined degree.

The noise-absorbent member may be made from a foamed member having an elastic resilience.

In another aspect, there is provided a fan motor apparatus comprising a motor including a motor casing having a plurality of motor discharge ports formed therein, the motor configured to draw in an external air stream through an inlet and discharge the airstream through the motor discharge ports, an outer casing including an open upper portion configured to receive and surround at least a portion of the motor casing and a discharge portion including a plurality of discharge ports, and a noise-absorbent member positioned between the motor and the casing and surrounding a portion

of the motor casing. The noise-absorbent member may be supported at least by a side frame of the discharge portion.

The noise-absorbent member may be air permeable and positioned such that it blocks the discharge ports.

The drawn in external air stream discharged from the motor discharge ports may be discharged from the discharge ports of the casing through the noise-absorbent member.

In response to an internal exhaust pressure of the fan motor exceeding a predetermined degree, the noise-absorbent member may be deformed to form a leakage space, thereby reducing the internal exhaust pressure of the fan motor.

In response to an internal exhaust pressure returning to a degree less than the predetermined degree, the noise-absorbent member may return to its original shape, thereby blocking the discharge port.

The motor may further include a brush portion and the casing may include a discharge passage pipe which receives the brush portion of the motor.

The fan motor apparatus may further include at least one support formed at a lower inner side of the side frame and configured to support a lower side of the noise-absorbent member.

The at least one support may be formed as at least one rib extending from a lower inner circumference of the side frame to a center of the discharge portion.

The fan motor apparatus may further include an upper frame extending from an upper portion of the side frame and is configured to support an upper edge of the noise-absorbent member.

The upper frame may be formed as at least one rib extending from the upper inner circumference of the side frame.

Other features and aspects will be apparent from the following detailed description, the drawings and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a perspective view illustrating an example of a fan motor apparatus.

FIG. **2** shows an exploded perspective view illustrating the example of the fan motor apparatus of FIG. **1**.

FIG. **3** shows a partial cross-section of the example of the fan motor apparatus taken on line III-III of FIG. **1**, illustrating a noise-absorbent member connected to an outer casing.

FIG. **4** shows a bottom perspective view of an example of the fan motor apparatus, illustrating a noise-absorbent member in normal state.

FIG. **5** shows a bottom perspective view of an example of a fan motor apparatus, illustrating a noise-absorbent member in deformed state due to increased internal exhaust pressure of the fan motor apparatus.

Throughout the drawings and the detailed description, unless otherwise described, the same drawing reference numerals will be understood to refer to the same elements, features, and structures. The relative size and depiction of these elements may be exaggerated for clarity, illustration, and convenience.

DETAILED DESCRIPTION

The following detailed description is provided to assist the reader in gaining a comprehensive understanding of the methods, apparatuses, and/or systems described herein. Accordingly, various changes, modifications, and equivalents of the systems, apparatuses, and/or methods described herein will be suggested to those of ordinary skill in the art. Also, descriptions of well-known functions and constructions may be omitted for increased clarity and conciseness.

FIG. **1** illustrates a perspective view showing an example of a fan motor apparatus. FIG. **2** illustrates an exploded perspective view of the example of a fan motor apparatus of FIG. **1**. FIG. **3** illustrates a partial cross-section of an example of the fan motor apparatus taken on line III-III of FIG. **1**, illustrating a noise-absorbent member is connected to an outer casing.

Referring to FIG. **1**, an example of a fan motor apparatus **100** includes a fan motor **10**, an outer casing **20**, and a noise-absorbent member **30** inserted and supported in an area where the fan motor **10** and the outer casing **20** are connected to each other.

The fan motor **10** may have a structure in which an impeller unit **11** having an inlet **1** formed in the middle, is connected to an upper portion of the motor **12**. A plurality of motor discharge ports **13** may be formed on a portion of the motor casing **12***a* that forms an outer portion of the motor **12**. The motor casing **12***a* may also enclose therein general components of the motor, which may include an end through which a carbon contact portion of a brush **16** is exposed, a stator, a rotor, a commutator, and a motor shaft.

In the example of the fan motor **10** with the above-mentioned structure, a vane connected to the motor shaft arranged inside the impeller unit **11** rotates as the motor **12** starts driving, thereby drawing in an external air stream into the motor **12** through the inlet **1**. The drawn in air stream is then discharged out through the motor discharge ports **13**.

The outer casing **20** may surround the fan motor and include a discharge portion **21**, discharge passage pipes **24**, and a motor securing protrusion (not illustrated). The outer casing **20** may have an open upper portion and a closed lower portion.

The discharge portion **21** may include a side frame **22** to support the noise-absorbent member **30** on an outer circumference of the open portion of the outer casing **20**, a plurality of supports **22***a*, a plurality of upper frames **23**, and discharge ports **2**.

A lower portion of the side frame **22** may be connected to form a plurality of discharge ports **2** in cooperation with the outer circumference of the open portion of the outer casing **20**, and may support the side of the noise-absorbent member **30**. Although the side frame **22** is illustrated as square tubes in FIGS. **1** to **5**, the side frame **22** may take other forms such as cylinder or appropriate polygon, for example.

A plurality of recessed portions **21***a* may be formed from the upper portion of the side frame **22** down to a predetermined depth to extend the area of the discharge ports **2** and to thus facilitate the exhaustion of air. The supports **22***a*, which may be shelf-shaped, for example, may be formed on a lower inner side of the side frame **22** to support the lower side of the noise-absorbent member **30**.

The upper frames **23** may be extended from the upper portion of the side frame **22** to the center of the discharge portion **21**, to support an upper edge of the noise-absorbent member **30** where the noise-absorbent member **30** is connected to the discharge portion **21**.

The areas where the noise-absorbent member **30** is exposed outside in the discharge port **21** are the discharge ports **2** of the outer casing **20** to discharge air stream.

In an alternative example, the side frame **22** may be formed as a cylindrical tube having a diameter larger than that of the open upper portion of the outer casing **20**, and be connected to the outer circumference of the open upper portion of the outer casing **20** with a predetermined lower portion thereof. However, the configuration of the side frame **22** is not limited to the examples described above.

Further, instead of being formed in a shelf-shape, the supports **22***a* may be formed as a rib which may be integrally

extended from the entirety of a lower inner circumference of the side frame **22** to the center of the discharge portion **21**. Alternatively, the supports **22***a* may be formed as a plurality of ribs separately extended from the lower inner circumference of the side frame **22** to the center of the discharge portion **21**.

Likewise, the upper frames **23** may also be formed as a rib which may be integrally extended from the entirety of the upper inner circumference of the side frame **22**, or as a plurality of ribs separately extended from the upper inner circumference of the side frame **22** to the center of the discharge portion **21**.

If the fan motor **10** is connected to the outer casing **20**, the discharge passage pipes **24** help the brush **16** to be inserted smoothly, and also facilitate the moving of air streams, which are discharged through a motor discharge port **13** formed in a lower portion of the motor **12**, to the discharge portion **21** of the outer casing **20**.

The noise-absorbent member **30** may have an outer shape to correspond to that of an inner area of the discharge portion **21**, and may also include a motor coupling hole **31** formed in the center to receive the motor **12**. The noise-absorbent member **30** may be formed from a resilient member having a predetermined level of air permeability for air exhaustion, deformability by pressure, and recoverability to original shape on cessation of pressure application. The resilient member may include polyurethane foam, for example, which may be made from polyurethane by foaming and expansion molding. However, the material and method of forming the noise-absorbent member are not limited to these examples, as other suitable materials and manufacturing methods may be used as well.

In the structure explained above, the noise-absorbent member **30** may be inserted in the discharge portion **21** of the outer casing **20** and supported therein. The noise-absorbent member **30** may be inserted in the discharge portion **21** unfixedly, that is, without requiring a separate fixing process such as bonding, gasket coupling, or the like. The outer side of the noise-absorbent member **30** may be supported on the side frame **22**, the lower side may be supported on the supports **22***a*, and the upper portion may be supported on the lower side of the outer circumference of the impeller unit **11** and the upper frames **23**. As a result, the noise-absorbent member **30** may be mounted or demounted easily.

The fan motor **10** may be connected to the outer casing **20** in a manner in which the motor **12** is inserted in the outer casing **20** through the motor coupling hole **31**. At this time, since the brush **16** is placed in the discharge passage pipe **24**, the brush **16** does not interfere with the fan motor **10** which is being inserted in the outer casing **20**.

Once the fan motor **10** is connected to the outer casing **20**, the fan motor **10** may be secured firmly to the outer casing **20** by a motor fixing protrusions (not illustrated), and thus assembled to the fan motor apparatus **100**.

In the example of a fan motor apparatus **100** assembled as explained above, and with reference to FIG. **3**, the fan motor **10** draws in external air stream into an internal space through the inlet **1**. The drawn in air stream is moved along a discharge passage **5** formed between the motor casing **12***a* and the outer casing **20** through the motor discharge port **13**, passed through the noise-absorbent member **30** connected to the discharge portion **21**, and discharged through the plurality of discharge ports **2**. In this case, the discharge passage pipe **24** of the outer casing **20** may facilitate the moving of the air stream discharged from the motor **12** to the discharge portion **21**, and also help to decrease the exhaust pressure of the air stream.

With further reference to FIG. **3**, an air stream (o**1**) is discharged from inside the impeller unit **11** to inside the motor **12**, another air stream (o**2**) is discharged to the discharge passage **5** through the motor discharge port **13**, and yet another air stream (o**3**) is discharged through the discharge ports **2**.

An example of the noise-reducing operation of the fan motor apparatus **100** with the above-mentioned structure is explained below.

For the purpose of noise reduction, the outer casing **20** may be connected to the fan motor **10** in a manner of surrounding the outer portion of the motor **12**. In this way, the outer casing **20** may insulate the noise generated from the motor **12** from outside.

The discharge passage tube **24** may increase the volume of the air stream discharged through the motor **12** so as to decrease the pressure, and subsequently decrease air velocity and noise generated from the air flow.

The noise-absorbent member **30** may reduce noise generated from the fan motor apparatus **100** by blocking the discharge ports **2** of the discharge portion **21**. That is, the noise-absorbent member **30** may absorb noise from the motor **12**, block noise leaking out of the fan motor apparatus **100** through the discharge ports **2**, and reduce velocity and also absorb noise of the air stream discharged through the discharge ports **2**.

Meanwhile, the fan motor apparatus **100** may have an increase of internal exhaust pressure if minute foreign matters left unfiltered in the air stream are caught in the air holes of the noise-absorbent member **30**, causing the air permeability of the noise-absorbent member **30** to deteriorate.

According to one aspect, the fan motor apparatus **100** may prevent internal exhaust pressure from rising, or reduce the likelihood that internal exhaust pressure will rise, above a predetermined level, since the noise-absorbent member **30** may deform and discharge the internal air of the fan motor apparatus **100**, if internal exhaust pressure increases.

An example of the process of preventing or reducing the likelihood of the increase of internal exhaust pressure of the fan motor apparatus **100** by changing the shape of the noise-absorbent member **30** is explained below with reference to FIGS. **4** and **5**.

FIG. **4** illustrates a bottom perspective view of an example of a fan motor apparatus, illustrating a noise-absorbent member in normal state. FIG. **5** illustrates a bottom perspective view of an example of a fan motor apparatus, illustrating a noise-absorbent member in a deformed state due to increased internal exhaust pressure of the fan motor apparatus.

The fan motor apparatus **100** may perform normal air suction or discharge operation unless the noise-absorbent member **30** has degraded air permeability.

If the fan motor apparatus **100** is in normal operation state, the noise-absorbent member **30** does not change its shape as the internal air of the fan motor apparatus **100** is discharged through the noise-absorbent member **30**. At this time, the noise-absorbent member **30** absorbs the noise generated from the motor **12** and the air stream.

As the fan motor apparatus **100** continues driving, fine particles of dusts may not be separated from the discharged air stream, but caught in the noise-absorbent member **30**. As a result, the noise-absorbent member **30** may gradually have degraded air permeability. With the degraded air permeability, the noise-absorbent member **30** may not be able to pass air stream smoothly, in which case the fan motor apparatus **100** may have continuously increasing internal exhaust pressure. The increase of internal exhaust pressure of the fan motor

apparatus **100** may cause overload of the motor **12** and keep the noise-absorbent member **30** under constant pressure.

However, in one example, since the noise-absorbent member **30** is connected and supported on the discharge portion **21**, the noise-absorbent member **30** is capable of deforming easily. That is, the noise-absorbent member **30** may change its shape by the exhaust pressure, if exhaust pressure exerted to the noise-absorbent member **30** is above a predetermined degree.

Referring to FIG. **5**, for example, if the noise-absorbent member **30** changes its shape, a leakage space **32** may be formed in the discharge ports **2** so the internal air of the fan motor apparatus **100** may be discharged out rapidly. As a result, the internal exhaust pressure of the fan motor apparatus **100** may decrease.

If the fan motor apparatus **100** is returned to the normal internal exhaust pressure due to the leakage space **32**, the noise-absorbent member **30** is returned to the original shape, closing the discharge ports **2** of the discharge portion **21**.

As explained above, since the noise-absorbent member **30** is unfixedly supported on the discharge portion **21** in a manner in which the noise-absorbent member **30** is exposed outside, the noise-absorbent member **30** deforms if the internal exhaust pressure of the fan motor apparatus **100** is increased, thereby efficiently forming the leakage space **32**. Accordingly, since the internal air of the fan motor apparatus **100** is discharged rapidly, the internal exhaust pressure of the fan motor apparatus **100** is prevented from rising to above a predetermined degree.

Further, since motor overload due to increase of internal exhaust pressure of the fan motor apparatus **100** is prevented or deterred, noise due to motor overload may be avoided.

Further, since motor overload is prevented or deterred, motor malfunction due to overload is prevented or deterred, and a vacuum cleaner may have an extended life span.

Further, since the noise-absorbent member **30** is unfixedly supported, and thus is capable of changing its shape, it may be easy to mount or demount the noise-absorbent member **30**. Accordingly, even when the noise-absorbent member **30** is blocked due to foreign matters caught therein, it may be easy to replace or clean the noise-absorbent member **30**. As a result, a vacuum cleaner may have improved ease of maintenance.

Further, since only one noise-absorbent member **30** and one outer casing **20** are required to reduce noise of the fan motor apparatus **100**, the fan motor apparatus **100** may have a reduced number of components and simplified structure.

Further, since the number of components may be reduced and the structure is simplified, the fan motor apparatus **100** may have a reduced size, and accordingly, the vacuum cleaner employing the fan motor apparatus **100** may also have a reduced size.

Further, due to a reduced number of components and simplified structure, the fan motor apparatus **100** or the vacuum cleaner having the fan motor apparatus **100** may be fabricated efficiently with a reduced manufacture cost and increased productivity.

A number of examples of embodiments have been described above. Nevertheless, it will be understood that various modifications may be made. For example, suitable results may be achieved if the described techniques are performed in a different order and/or if components in a described system, architecture, device, apparatus or circuit are combined in a different manner and/or replaced or supplemented by other components or their equivalents. Accordingly, other implementations are within the scope of the following claims.

What is claimed is:

1. A fan motor apparatus for a vacuum cleaner, comprising:

a fan motor;

an outer casing surrounding at least a part of the fan motor, wherein the outer casing includes a discharge portion having a discharge port; and

a noise-absorbent member supported by the discharge port-portion such that the discharge port is closed when an internal exhaust pressure of the fan motor is below a predetermined degree, the noise-absorbent member changes its shape to form a leakage space when an internal exhaust pressure of the fan motor exceeds a predetermined degree, and wherein the discharge portion comprises a side frame formed on a side surface to support the noise-absorbent member, a support portion protruding from a lower inner portion of the side frame to support a lower surface of the noise-absorbent member, and at least one upper frame extending inward from the side frame to support an upper surface of the noise-absorbent member on an upper portion of the side frame.

2. The fan motor apparatus of claim **1**, wherein the discharge port is formed at the side frame.

3. The fan motor apparatus of claim **2**, wherein the side frame comprises at least one recessed portion extending downwardly from an upper portion.

4. The fan motor apparatus of claim **1**, wherein the noise-absorbent member is returned to an original shape if the internal exhaust pressure of the fan motor is returned to a degree less than the predetermined degree.

5. The fan motor apparatus of claim **1**, wherein the noise-absorbent member is made from a foamed member having an elastic resilience.

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